

## TJ MICROWAVE RADIO SYSTEM TESTS — TELEPHONE WITH DIVERSITY GENERAL

### 1. GENERAL

**1.01** This section and related sections in this series describe the methods of making over-all system tests and adjustments on a TJ radio system. These tests can be performed at the radio stations using portable test equipment.

**1.02** This section replaces Issue 2 and is reissued to include information contained in an Addendum dated November, 1961. This information was inadvertently omitted when the section was converted to the Plant Series. It provides for removing a receiver from service and restoring it to service upon completion of tests and adjustments.

**1.03** Test equipment required in the specific procedures should be located so that it is available at one or more stations as required. The test equipment required for individual unit tests is listed in the sections covering those tests.

**1.04** If routine tests reveal troubles which cannot be cleared on the site, plug-in units should be replaced and the faulty units returned to the Western Electric Company for complete overhaul.

**1.05** Tests and adjustments should be made at the time of initial installations and at the suggested test intervals shown in Section 409-200-330.

**1.06** The procedures outlined are based on the premise that maintenance personnel are familiar with the operation of the test equipment. Detailed information about the use of the various items of test equipment supplied by outside manufacturers can be obtained from the instruction manuals provided. J-coded test equipment information is covered in division 104 of the Bell System Practices.

**1.07** Test equipment required for system tests is as follows:

- 1 — KS-14510 Volt-ohm-milliammeter
- 1 — KS-15538 Carrier Frequency Voltmeter
- 1 — KS-16647 RF Test Set
- 1 — J68376A Transmitter Disconnect Unit
- 1 — J68376B IF Test Set
- 2 — J68376C Impedance Matching Test Sets
- 1 — Hewlett-Packard 130A or 130B Oscilloscope
- 1 — Hewlett-Packard 200CD Oscillator
- 1 — Hewlett-Packard 650A Oscillator

**1.08** A system consists of a combination of through (repeater) or dropping and inserting (terminal) radio arrangements. Levels and patching arrangements will necessarily vary with the type of multiplex and route arrangement. Figure 1 (terminal) and Figure 2 (repeater) show levels corresponding to single tone full deviation of the radio. These levels were chosen since they are used in alignment of individual radio components. Figures 1 and 2 merely show level relationships of various points in the system. They should not, under any circumstance, be used in aligning the system.

**1.09** The proper 8-mc peak-to-peak frequency deviation of the transmitting klystron is obtained by supplying a square-wave test signal of the appropriate amplitude to the system from a KS-16647 RF test set and adjusting the GAIN control of the transmitting baseband amplifier for the required deviation. The proper attenuation pad must also be inserted between SIG OUT and TRS IN on the Diversity Switch and Transmission Unit. This procedure is covered in Section 409-240-503. It should be done at the time of initial installation, whenever a transmitting klystron is replaced, or a change is made in the transmitter baseband amplifier.

## 2. MAINTAINING SERVICE AND REMOVING LINK FOR TESTS

**2.01** When making tests on a system in service and the transmitter or receiver is removed from service for tests and adjustments, the particular link must be isolated and service maintained on the leg of the diversity pair NOT under test. Before proceeding, the Control Center should be contacted and requested to initiate and verify a switch to the channel which is to remain in service.

### 2.02 *Removing Transmitter from Service*

When tests are to be performed at the transmitter end of the link, the link may be isolated by SLOWLY removing the blade of the waveguide switch and replacing it SLOWLY in the OFF position. If the diversity switch at the receiving end of the link is operated to the leg to be isolated, it will operate and transfer service to the other leg of the diversity pair.

**Caution:** *The blade of the waveguide switch must be removed and reinserted SLOWLY to prevent errors when data is being transmitted.*

The above procedure should be followed even though the link has been switched by the Control Center since fading could have caused a switch back to the channel to be removed from service. Diversity links should not be taken out of service during periods of fading unless absolutely necessary.

**2.03** The J68376A Transmitter Disconnect Unit is used to remove the transmitter from service. AFTER the link has been isolated. It is essentially a balanced 124-ohm attenuator mounted in a portable case and arranged to hang on the front panel of the Diversity Switch and Transmission Unit. It is connected into the circuit ahead of the transmitter and introduces loss in small enough steps to prevent a transmission hit on the working leg of the diversity pair. In its maximum loss position, it terminates the line and allows the transmitter to be removed from service.

**2.04** The procedure for removing a transmitter from service using the J68376A Transmitter Disconnect Unit is as follows:

(a) With the ATTENUATION DB switch S2 on the INSERT position, patch the transmitter disconnect unit between the TRS MON and TRS TST jacks on the diversity switch and transmission unit. Observe the tip-to-tip and ring-to-ring polarization.

(b) Remove the 372A patching plugs connecting Y PAD OUT to TRS PAD.

(c) Slowly operate the ATTENUATION DB switch on the disconnect unit to the DISC position.

(d) Remove the patch between the disconnect unit and the TRS TST jack on the diversity switch and transmission panel.

### 2.05 *Restoring Transmitter to Service*

(a) Restore the patch between the disconnect unit and the TRS TST jack on the diversity switch and transmission unit.

(b) Slowly operate the ATTENUATION DB switch to the INSERT position.

(c) Restore the 372A patching plugs connecting Y PAD OUT to TRS PAD.

(d) Remove the transmitter disconnect unit.

### 2.06 *Removing Receiver from Service*

As outlined in Par. 2.01, the particular link to be tested must be isolated before any tests or adjustments can be made. When the receiver is removed from service and tests require that the input signal to the receiver or any of its component units be disconnected, the 291A squelch relay must be removed from its socket and a W.E. Co. 404A plug substituted in its place. The absence of an input signal to the receiver causes the squelch relay to operate which opens the path of the +200 volt plate supply to the baseband amplifier. In order to make the receiver operative for tests, this substitution re-connects the +200 volt plate supply to the baseband amplifier. Under this condition the squelch circuitry is disabled.

### 2.07 *Restoring Receiver to Service*

When the receiver is to be restored to service after tests and adjustments, the 291A squelch relay must be resubstituted for the 404A plug. Tap the relay envelope lightly to ensure that no mercury is adhering to the relay contacts.

**2.08 Restoring the Link to Service**

Restore the link to service by replacing the blade of the waveguide switch to the ON position. Notify the Control Center and request that orders be sent to ensure that the link is operative.

**3. USE OF ALTERNATIVE TEST EQUIPMENT**

**3.01** In areas where a 61C signal generator is available and the baseband frequency range exceeds 500 kc, the 61C generator instead of the Hewlett-Packard 650A oscillator may be used for the frequency characteristic tests outlined in Section 409-240-505. The 200CD oscillator may be connected as an external oscillator to the EXT OSC IN jack of the 61C generator, and in this manner the level controls, attenuators, and level monitor may be used to monitor the oscillator output.

**3.02** In areas where the 37B transmission measuring set is available, it may be used in place of the KS-15538 carrier frequency voltmeter when making pilot level tests as outlined in Section 409-240-505.

**4. USE OF KS-14510, LIST 1  
VOLT-OHM-MILLIAMMETER**

**4.01** When using the KS-14510 volt-ohm-milliammeter care should be exercised that this instrument is used in the *horizontal* position only. If the bearings are even slightly worn, there may be a difference in the voltage readings taken in the vertical and horizontal positions. Inasmuch as this meter is tested in the horizontal position, and in the interest of uniformity of reading, it would be well to *always* use it in this position.



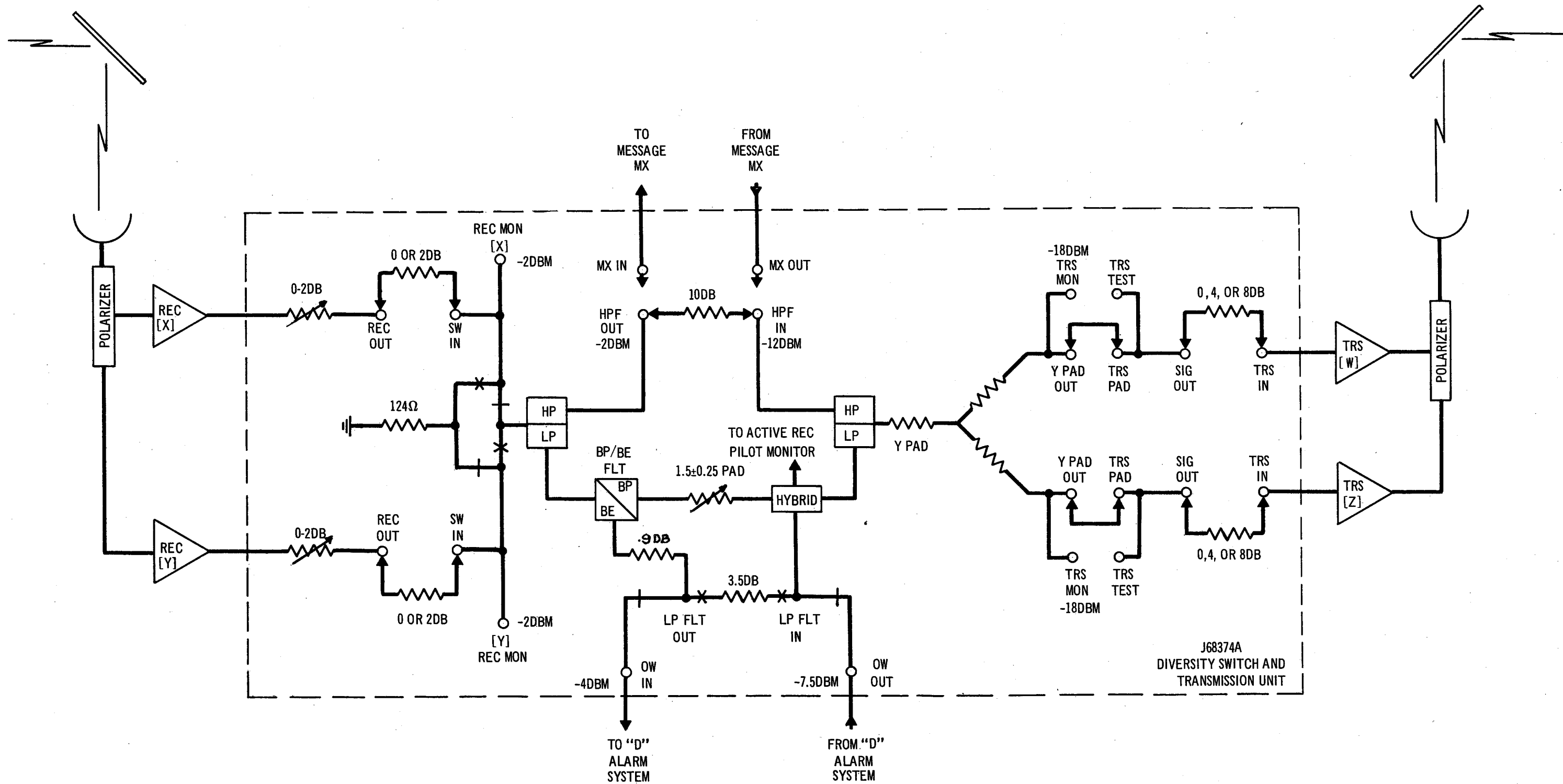


Fig. 2 - Typical TJ Radio Repeater — (Levels with 8 mc Peak-to-Peak Deviation)